USGS
science for a changing world

The Human Footprint in the West: A Large-scale Analysis of Anthropogenic Impacts

Background

Wildlands in the western United States have changed dramatically over the past 50 years primarily because the expansion in human populations has increased the demand for the resources and use of these lands. Changes associated with urban expansion and development of rural areas directly influence the number and kinds of plants and wildlife that remain. Additional and sometimes more subtle influences on these ecosystems result from the roads, powerlines, and other networks and land uses necessary to maintain human populations. The "human footprint" represents the cumulative impact of anthropogenic actions on the landscape. These actions can impact wildlife, such as Greater Sage-grouse (*Centrocercus urophasianus*), which is a species of conservation concern. One way by which impacts can occur is from the "top-down"—developing conditions that increase the number of predators or facilitate their movements through the landscape. Alternatively, other activities may affect wildlife from the "bottom-up"—creating unsuitable habitats (see "Top-down Versus Bottom-up Effects"). At the USGS Forest and Rangeland Ecosystem Science Center, we are developing spatial models of the human footprint to better understand potential influences on shrubland ecosystems and associated wildlife in the western United States.

Development of the Human Footprint Map

We developed the map of the human footprint from an analysis of the landscape structure and anthropogenic features of the western United States. The map, which is focused on shrubland ecosystems, combines models of habitat use by avian predators (top-down effects) and the risk of invasion by exotic plants (bottom-up effects) to estimate the synergistic influence of human activities. All datasets used in the analysis are archived on the SAGEMAP website (http://sagemap.wr.usgs.gov), which is maintained by USGS at the Snake River Field Station.

Modeling the habitat features that benefit avian predators is important in order to understand the increased predation pressures on sage grouse and other shrubland birds as a result of human activities. For example, power lines are used by common ravens (*Corvus corax*) and other raptors for nesting and for hunting perches. Linear features such as railroads, primary and secondary roads, and irrigation channels often serve as travel routes for these predators and expand their movements into previously unused regions. Numbers of common ravens, American crows (*Corvus brachyrhynchos*), black-billed magpies (*Pica hudsonia*), and brown-headed cowbirds (*Molothrus ater*) increase in areas surrounding rural human developments, campgrounds, landfills, rest stops, and agricultural lands because of the availability of new and often highly abundant food sources (Fig. 1).

Black-billed magpie

U.S. Department of the Interior
U.S. Geological Survey

USGS FS-XXX-03
Month 2003